The Economics of Central Bank Digital Currency

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Abstract:

Central bank digital currency (CBDC) is emerging as the future of banking and payments. We analyze CBDCs' benefits to consumers and the economy and some concerns associated with their use.

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Article:

The current trend of central bank activities clearly shows that central bank digital currency (CBDC) is likely to be the future of banking and payments. In late 2020, the international financial institution owned by central banks, Bank for International Settlements (BIS), surveyed more than 60 central banks about their engagement in digital versions of fiat currency work and found that 86% were exploring CBDCs.[1] In October 2020, Central Bank of the Bahamas (CBB) launched the digital Bahamian Dollar (B$), known as "the sand dollar," which was the world's first CBDC.[2] Parties transacting in the sand dollar benefit from the legal-tender status since it uses a liability of the CBB, which is viewed as the safest form of payment in the country.

Major world economies such as Brazil, China, the Eurozone, Japan, Russia, the United Kingdom, and the United States are undergoing various phases of research exploration and trial of CBDCs.[3] CBDCs utilize different models and widely differ in terms of factors such as target users and the types of technologies used. China's digital yuan, or e-CNY, for instance, is being tested for retail use by the public. Other economies, such as Hong Kong[4] and Australia, are developing CBDCs targeted at financial institutions. In November 2020, Australia's central bank and banknote-issuing authority, the Reserve Bank of Australia, announced a partnership with multinational bank Commonwealth Bank of Australia, another bank serving Australia National Australia Bank, investment and trustee group Perpetual, and blockchain company ConsenSys to explore the potential use and implications of a wholesale form of distributed ledger technology (DLT)-based CBDC. The project's goal was to develop a proof-of-concept (PoC) based on an Ethereum-based platform for issuing a tokenized form of CBDC for the wholesale market, which involves borrowing and lending among institutional banks.[5]

Ripple, which is a semicentralized system,[6] is also being viewed as a platform for developing, issuing, and managing CBDCs. Quoting a report of the professional accounting body, CPA Australia, media outlets reported that France's central bank, the Banque de France, has shown interest in exploring Ripple as a platform for issuing its CBDC.[7]

In November 2020, the central banks of Saudi Arabia and the United Arab Emirates (UAE) concluded a joint CBDC PoC, referred to as the "Aber" project. The project was launched in January 2019.[8] The goal was to test the viability of a shared digital currency between the two countries. The project used Hyperledger Fabric, which is a permissioned blockchain associated with Linux Foundation and IBM. In addition to the two central banks, six local commercial banks participated to run the nodes.[9] A key finding was that, compared to centralized payment systems, the use of DLT can improve domestic and cross-border commercial bank settlements.[10] The Aber project built on earlier trials conducted in other countries, such as Singapore's Project Ubin and Canada's Project Jasper.[11]

Benefits to Consumers and the Economy

Some of the key potential benefits of CBDCs vis-à-vis fiat currencies and other payment systems are presented in Table 1. They are also illustrated in the case of e-CNY, also commonly referred to by its original project name, Digital Currency Electronic Payment (DCEP), which is in the most advanced stage of development among CBDC projects of major economies.

Table 1. The key benefits of CBDC to consumers and the national economy.

Benefit	Explanation	The case of DCEP/e-CNY
Reliable low-risk payment solution	• There are more reliable means to carry out payment settlements compared to other available means.	• Private companies such as Alipay and WeChat Pay face risks such as business failure and bankruptcy.
Low costs and high efficiency	• There are faster transactions at lower costs	• It is likely to be free for vendors to accept e-CNY payments.
Promoting financial inclusion of disadvantaged groups	• For a digital wallet linked to the CBDC account through application programming interfaces, no account in a bank is needed to engage in transactions. • Traceability and the possibility of conducting transactions without a smartphone can promote financial inclusion of disadvantaged groups.	• People's Bank of China can monitor the flow of money and deliver targeted programs to improve the well-being of high-risk/disadvantaged groups. • The December 2020 Suzhou trial involved offline payments.
Combating economic crimes and frauds	• They are more traceable than fiat currencies and other payment systems for the government. • Blockchain-based cryptocurrencies employ cryptography. • Blockchains are likely to be permissioned, which is another defense layer.	• It is described as "controllable anonymity" and is expected to control money laundering, terrorism financing, and tax evasion. • It employs asymmetric cryptography.

It is worth noting that the relative importance of different benefits varies across economies. A BIS survey of 63 central banks [41 in emerging market economies (EMEs) and 22 in advanced economies] found that EMEs value domestic payments' efficiency and financial inclusion as the top two benefits of CBDCs. On one hand, cross-border payments' efficiency was the least important benefit for EMEs. Central banks in advanced economies, on the other hand, viewed payments' safety and financial stability as CBDCs' primary benefits. Financial inclusion was considered to be the least important factor by this group.[12]

Reliable Low-Risk Payment Solution

A state-backed digital currency is the most reliable means to carry out payment settlements. In a CBDC transaction, just like in an exchange of banknotes, as soon as the possession changes, a final settlement is reached between the parties. With transactions, such as cashless payments by credit card, wire, check, and digital apps, a deal is not fully settled when one party makes a payment to another. That is, until the banks have recorded, reconciled, and settled their respective debits and credits, there is a possibility that the transaction could be reversed.[13] In China, for instance, Alipay and WeChat Pay rely on commercial banks to settle payments.[14] Parties that rely on private companies such as Alipay and WeChat Pay face risks, such as business failure and bankruptcy of companies in payment ecosystems.

Low Costs and High Efficiency

Parties in a transaction may achieve high efficiency and low costs with CBDCs. Eliminating intermediaries could be a key mechanism to reduce transaction costs. The vendors are required to pay a service fee when consumers use e-payment systems such as WeChat Pay and Alipay or credit cards. In China, the fee is usually 0.6% of the total amount.[15] The Chinese government has indicated that it will be free for vendors to accept e-CNY payments.

In Table 2, we compare the throughputs of some major payment systems in terms of transactions per second (TPS). Specifically, this table compares the throughputs of China's DCEP, Ripple (being considered by the Banque de France), Hyperledger Fabric (used by the Aber project of the central banks of Saudi Arabia and the UAE), and Ethereum (used to develop a PoC by the Reserve Bank of Australia) with some other crypto and noncrypto payment solutions.

Table 2. The efficiency and performance indicators of some major payment systems.[29,30]

Payment system	TPS	Remarks
DCEP	About 220,000	December 2019, peak TPS[31]
Ripple	Average: 1,500[32]	CBDC private ledger: Ripple claimed that it can handle tens of thousands of TPS in the initial phase, which can be increased to hundreds of thousands of TPS over time
Bitcoin	Average: 5.15	Complete decentralization has reduced performance
Ethereum	Average: 20	Ethereum 2.0 has an expected 100,000 TPS
Hyperledger Fabric	Average: 3,500	Deployed in a single cloud data center (early 2018)
Visa	Average: 1,700	Can handle more at peak load
Diem	Average: about 3 (January 2021)[33]	In the testing phase, testnet Original Libra white paper envisioned 1,000 TPS34

The CBDCs being planned by major economies are expected to perform well in terms of throughput (Table 2). China's DCEP is expected to potentially have much higher transaction processing rates than other CBDCs. Ripple's CBDC Private Ledger, which is built for issuing currencies, uses the same technology that has powered the ledger for its digital currency, XRP.[16] The firm reported that it is in discussion with central banks worldwide to assess how its CBDC private ledger can be used to issue digital currency. As to the mechanisms needed for various CBDCs to interact, Ripple has advocated for the use of its cryptocurrency XRP as a

bridge or a vehicle to efficiently move from the value from one CBDC to another in a frictionless manner.[17] Likewise, Ethereum is currently in the process of upgrading to Ethereum 2.0, which is expected to increase speeds to 100,000 TPS.[18]

Promoting the Financial Inclusion of Disadvantaged Groups

In the current system, checking and savings accounts with financial institutions are the primary means to gaining access to credit. In developing economies, financial institutions are not easily accessible. Opening a bank account in developing as well as developed countries may involve a number of barriers, such as formal identification, a minimum deposit and balance, and a local bank branch.[19]

Commercial banks often find it unprofitable to serve poor people and small businesses in remote and marginalized regions. Moreover, if the majority of consumers start using electronic and digital payments, such as online/mobile payments and digital wallets, the infrastructure for cash payments may suffer, and cash might no longer be an option in these regions. Such a situation might lead to further marginalization of the poor.

The International Monetary Fund argues that digital currency offers great promise to reaching disadvantaged groups.[20] A retail CBDC system, in which a central bank issues digital currency directly to people without the need for traditional bank accounts, can address many of the previous challenges. This can be achieved through the establishment of an inclusive digital payment ecosystem and the creation of financial data identities. For instance, individuals can have a CBDC account on the central bank's ledger. A digital wallet application linked to the CBDC account through application programming interfaces can allow users to access their accounts and engage in transactions.[19]

CBDCs can thus promote financial inclusion of low-income groups and small and medium enterprises.[6] For instance, since e-CNY is highly traceable, the central bank, PBoC, can monitor the flow of money in the Chinese economy.[15] This allows the government to deliver targeted programs to improve the well-being of high-risk and disadvantaged groups, such as small businesses and low-income households.

Viewed from the perspective of the rural low-income population, the trial conducted in December 2020 in city of Suzhou in the Jiangsu Province in eastern China deserves mentioning. The trial involved e-CNY's offline payments without smartphones. It explored mechanisms that allow the completion of transactions by touching two devices via near-field communication (NFC). Since one-third of China's population lacks Internet access, this trial is important to understanding the opportunity of expanding e-CNY in rural China.

Combating Economic Crimes and Frauds

Compared to a fiat currency, digital currencies are difficult to counterfeit.[21] CBDCs that are supported with blockchain employ complex cryptography to prevent double spending. This is the digital equivalent of preventing the making of an identical copy of a banknote. Blockchains used

for CBDCs are likely to be permissioned, which restricts the access to only authorized users, providing another layer of defense.[22]

While China's DCEP does not necessarily use blockchain, it employs asymmetric cryptography to enhance security.[23] The PBoC has stated that transaction records are encrypted, and unauthorized parties cannot access them.

Governments are also likely to use CBDCs to combat economic crimes. At a BIS seminar, the director-general of the PBoC's digital currency institute Mu Changchun proposed global rules, which emphasize the importance of synchronizing the flows of information and funds so that regulators can monitor the compliance of transactions.[24] A PBoC official noted that the DCEP's "controllable anonymity," rather than full anonymity, is based on international consensus to satisfy antimoney laundering, antiterrorism financing, and antitax-evasion requirements.[25] By tracking and recording the details of all transactions, the government is in a better position to prevent and control illegal transactions.

Privacy Violation and Surveillance-Related Concerns

While the aforementioned benefits are attractive, CBDCs may also present some risks to consumers. Privacy is among the biggest concerns that critics have about CBDCs. From the privacy standpoint, there are at least three issues that need to be considered. First, CBDC transactions are not likely to be fully anonymous. Making data anonymous means preventing the identification of parties engaged in a transaction using special techniques. CBDCs, such as the DCEP, and decentralized cryptocurrencies, such as Bitcoin, differ in terms of who is intended to be prevented from identifying the parties in a transaction. For instance, both parties in a transaction involving DCEP can be anonymous to the public. DCEP thus provides a higher degree of anonymity when it comes to the ability of parties other than the Chinese government to identify the participants in a transaction. DCEP transactions, however, can be monitored by the PBoC. The e-CNY has users' personal information and other details to track and record every movement, such as where it is stored and how it is spent.

Second, when users' financial information is centralized, it can potentially be misused by the government. Such information is also likely to be targeted by cybercriminals.[26]

Third, there is a possibility that consumer data are shared with third parties. In a 2020 report on CBDC, published by the central banks of the United States, Europe, England, Japan, Switzerland, Canada, and Sweden, and the BIS,[27] there was discussion of the possibility of allowing service providers to access consumer data, and to charge them a fee would be a way to cover the cost of a CBDC system. In China, e-CNY is expected to provide commercial banks with rich transaction data to profile a larger number of consumers and analyze their online behavior. They can thus experiment with different ways to monetize consumer data.[28]

While CBDCs' benefits such as the low cost of producing and storing, ease of use, and protection against counterfeiting are obvious, they can also reduce transaction costs by removing third-party intermediaries such as commercial banks. They can address various barriers to financial inclusion. CBDCs can also be issued in a pro-poor manner. For instance, consumers

involved in an e-CNY trial completed transactions with NFC technology, which did not require an Internet connection. The possibility of using DCEP with NFC is especially attractive for individuals and organizations in remote areas who lack Internet access or bank accounts. Countries that have created financial data identities can ensure higher efficiency and value addition from CBDC efforts.

CBDCs may adversely affect the businesses of financial and payment intermediaries, such as mobile and online payment platforms, banks, and microfinance institutions. In China, for instance, e-CNY may pose a direct challenge to the existing payment systems, such as WeChat Pay and Alipay.

From the consumers' standpoint, a downside of CBDCs is that the government is likely to track all transactions. Privacy concerns are even more salient in authoritarian regimes, given their aim of maintaining social control at all costs. For instance, among key driving forces in the development of the DCEP is, arguably, the Chinese Communist Party's (CCP) desire of social control. The CCP has regarded its centralized banking system as a key instrument of its economic power. By putting every transaction onto the PBoC's radar, the DCEP may strengthen the surveillance state.

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